

## **Specifications – 16T/S STANDARD ROLL MECHANISM**

### **PART 1 - GENERAL**

#### **1.1 INTRODUCTION**

- A. This specification describes the requirements for the labor, materials, and services necessary to fabricate, assemble, test, and prepare for shipment the Roll Mechanisms and related components to be installed by Others at the project location.

#### **1.2 RELATED DOCUMENTS**

- A. Drawings and general provisions of Contract, including General Conditions and other Specification Sections, apply to this Section.

#### **1.3 DESCRIPTION OF SYSTEM**

##### **A. GENERAL**

The Roll Mechanism forms a unitary assembly and will be used interchangeably in the AEDC Propulsion Wind Tunnel (PWT) wind tunnels for testing rear sting mounted models. The new Roll Mechanisms will replace current Roll Mechanisms. The current Roll Mechanisms are 40 years old and are not designed for use with the new continuous sweep test capabilities.

##### **B. ROLL MECHANISM**

The Roll Mechanism is used to precisely locate and orient sting-mounted models in the test section under a wide variation of applied loads. Its design is critical to ensuring that the models are remotely positioned within specific boundaries.

Each Roll Mechanism is designed for the following requirements:

Normal force (Fn)	± 32,000 Lbs
Axial force (Fa)	± 14,000 Lbs
Side force (Fs)	± 10,000 Lbs
Pitch moment (Mp)	+ 6,931,000 Lbs*in - 2,367,000 Lbs*in
Yaw moment (My)	± 1,104,000 Lbs*in
Roll moment static (Mr)	± 120,0000 Lbs*in
Roll moment dynamic (Mr)	± 60,0000 Lbs*in

The model and sting weights are included in the normal force  $F_n$ .

The above loads are referenced at wind tunnel Station 31.7.

The aerodynamic forces and moments act as single loads on the model during tunnel operation, and are not additive. All loads act in the tunnel coordinate system (loads do not change directions as the model pitches, yaws, or rolls).

Roll rate	Variable to 20 deg/sec max
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Roll position accuracy	$\pm 0.02$ deg
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The Roll Mechanism shall be suitable for service in an ambient temperature, which may range from 40 °F to 200 °F.

## 1.4 QUALITY ASSURANCE

### A. QUALIFICATIONS OF CONTRACTOR

1. The Contractor shall be familiar with the applicable codes, standards, and techniques used in fabrication of high precision automated systems. The Contractor shall have built components of similar size and complexity to that specified.

### B. QUALIFICATIONS OF WORKMEN

1. Throughout the progress of the work, the Contractor shall provide adequate numbers of workmen who are thoroughly skilled in the required crafts. In acceptance or rejection of items of this contract, the Contractor will make no allowance for lack of skill on the part of the workmen.
2. During fabrication, the Contractor shall provide at least one person who is thoroughly familiar with the requirements of this contract, and the necessary steps for its proper execution, and who shall personally direct all work performed.

### C. QUALITY CONTROL PROGRAM

1. The Contractor shall have and maintain a quality control system that will establish that all contract requirements (including materials, fabrication, inspection and testing by the Contractor) and inspection by AEDC are satisfied.

### D. INSPECTION AND TESTING

1. All material and workmanship shall be subject to inspection and test by the AEDC and/or designated representatives at any and all times during the fabrication.

Inspection of all or any part of the material, equipment, and workmanship may be waived by the AEDC, but this shall not in any way be interpreted as relieving the Contractor of his responsibility for the fabrication, inspection, and testing of all work in accordance with the requirements of this Specification. AEDC shall have the right to reject defective material or workmanship or to require its correction. Without charge therefore, rejected workmanship shall be corrected satisfactorily and rejected material shall be replaced with material, which meets the requirements of this Specification.

2. Contractor shall notify AEDC five working days in advance of the date for shop tests so that arrangements can be made to be present at the tests.
3. Test equipment and methods used in shop tests shall conform to the latest versions of codes and standards, and shall be subject to the approval by the AEDC.

## 1.5 PRODUCT PACKING, SHIPPING, STORAGE, AND HANDLING

### A. GENERAL

1. The Contractor shall be responsible for packaging and crating the Roll Mechanisms for shipment in accordance with the dispatch and packing requirements that form a part of this Specification, as outlined in other Sections of this Specification.
2. Each Roll Mechanism shall be shipped as a single-piece assembly.
3. Shipping will be provided by the Contractor.

### B. PROTECTION OF MATERIALS AND EQUIPMENT

1. The Contractor shall use all means necessary to protect the work and materials of this specification, including material which may be AEDC furnished, before, during, and after fabrication.
2. The Contractor shall protect materials and equipment, including surface finish, against detrimental conditions, including freezing and corrosion, during fabrication and storage, until shipped.
3. All threaded connections shall be sealed with steel caps or plugs.
4. Protection of items shipped to the Contractor for use during shop fit-up and acceptance test shall be considered the responsibility of the Contractor.

5. All exposed machined contact surfaces shall be coated with a removable rust preventative and protected against mechanical damage by suitable covers.
6. All reasonable requests of AEDC to protect such materials and equipment shall be complied with. The Contractor shall return to AEDC, in good order, any equipment items supplied by AEDC, which are not incorporated into the work.
7. If, as determined by AEDC, material, equipment, supplies, and work performed are not adequately protected by the Contractor, such property may be protected by AEDC and the costs thereof may be charged to the Contractor or deducted from any payments due to him.

## 1.6 STATUS & PROGRESS REPORTS

- A. Aerospace Testing Alliance (ATA) is required to submit to AEDC a monthly status and progress report for each work package. The monthly status report covers the following topics: (1) Work Accomplished, (2) Problems Encountered, (3) Tests and Certifications, (4) Procurement Status, (5) Inspection

The progress report is an estimate of the percent complete of the work package tasks. The ATA representative will prepare the monthly status and progress report based on inspection visits to the Contractor's shop or by telephone contact with the Contractor. The Contractor shall support the ATA representative in obtaining complete and accurate information for inclusion in the monthly reports.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

#### A. GENERAL

##### 1. Materials of Construction and Equipment

All materials for manufactured components shall be new, unused, and conform to the latest applicable specifications and standards as specified. All commercial components shall be new, unused, and standard products of manufacturers regularly engaged in the manufacture of the product.

##### 2. Materials Supplied by AEDC

The Contractor shall not be responsible for the adequacy of the material components that are furnished by AEDC; however, he shall be responsible for the protection of the material as specified in this Specification.

## 2.2 VERIFICATION OF PERFORMANCE

### A. GENERAL

1. All the equipment of this supply shall be assembled by the Contractor and a factory acceptance test performed in his shop before packaging and shipping to the Site. The factory acceptance tests shall be performed by the Contractor. The AEDC and/or ATA as their representative shall witness all of the shop tests and inspections.
2. The Contractor shall provide a test rig and furnish all services, other test equipment, labor and material, to conduct the factory acceptance of the Roll Mechanism. The Contractor shall be responsible for providing labor and supervisory personnel to conduct the acceptance tests and for coordinating with AEDC portions of the work to complete the acceptance tests. The Contractor shall fully document all tests performed and data taken during the acceptance tests. The objectives of the factory acceptance tests are:
  - a) Verify function of all limit switches
  - b) Verify function of the brake
  - c) Verify smoothness of operation at various speeds, under load, over the full range of travel of the driving mechanism
  - d) Verify range and repeatability of the position sensors
  - e) Verify the Roll Mechanism under maximum operating loads
3. AEDC will supply a temporary control system, including temporary wiring, for conductance of the factory acceptance tests. The AEDC shall be responsible for the operation of the control equipment and the Contractor shall be responsible for hookup of the control wiring.

### B. SPECIFIC TESTS

1. All moving parts shall be checked for freedom of movement within their full range of motion before connecting to the drives. There shall be no interference, excessive friction, or binding.
2. Sealing surfaces shall have uniform contact within specified tolerances without application of excessive force.

3. The encoder and limit switches shall be tested to verify their calibration and that they provide the proper outputs in response to inputs.
4. The drive system shall be operated under power and control from a temporary direct power source, to be provided to the Contractor by AEDC. The input pressure during operation shall be measured and monitored in order to make an assessment of the torque required to overcome inertia and friction, and of the uniformity of these factors.

Normal force, axial force, side force and roll moment test loads shall be applied in four steps: 25%, 50%, 75%, and 100% of the maximum operating loads. The deflection of the model sting shall be measured accordingly. At each step, the Contractor shall operate the Roll Mechanism through 3 cycles of full range at maximum speeds. Mark the start and stop of each cycle. The deflection of the model sting shall be measured accordingly.

5. Operational Smoothness Test

The Contractor shall: (1) operate the driving mechanism through 3 cycles of full range at one tenth of maximum speed; (2) operate the driving mechanism through 3 cycles of full range at maximum speed. Mark the start and stop of each cycle. The Vendor shall provide a basis for evaluating cyclic, or otherwise abnormal variations in driving force versus position of the output shaft.

#### C. TEMPORARY WIRING TO SUPPORT ACCEPTANCE TESTING

The specification does not require the Contractor to supply any permanent wiring associated with the fabrication of the Roll Mechanism. However, the installation of temporary wiring, hydraulic and electrical power equipment shall be required of the Contractor to support the operation of the Roll Mechanism during acceptance testing. All other required equipment and cabling necessary to connect acceptance test verification equipment shall be the responsibility of the Contractor.

### PART 3 - EXECUTION

#### 3.1 FABRICATION

##### A. HEAT TREATMENT

1. The Contractor shall submit copies of heat treatment specifications for all parts requiring heat treatment to meet the properties specified on the drawings.

2. For all heat treatment operations, temperature-time charts and records of quenching treatment, material test, etc., shall be submitted to AEDC. All records shall be identified with the parts.

#### B. LUBRICATION

1. Unless otherwise noted, the following standard lubricants shall be used:
  - a) Oil: Texaco Meropa 220
  - b) Grease: Esso MP Moly Grease
  - c) Solid Lubricant Texaco Molytex 2
2. All equipment requiring lubrication shall be lubricated prior to shop checkout and acceptance.
3. Lubricants and procedures recommended by the equipment manufacturer shall be strictly adhered to.
4. All parts received from other contractors or suppliers shall be checked for lubrication and relubricated, if required, before operation. Unless otherwise specified or shown on the drawings, all bearings are grease lubricated and shall be supplied prepacked with suitable grease.

#### C. MACHINING, TOLERANCES, FINISHES

1. All component parts shall be machined to the tolerances and surface finishes as specified on the Contract Drawings.
2. The Contractor shall perform a dimensional inspection of all dimensions denoted as critical on the contract drawings and furnish certified copies of the inspection report to AEDC prior to factory acceptance. Other dimensions shall be inspected in accordance with good shop practice and such inspections may be witnessed, spot checked, or reviewed by AEDC.

#### D. MECHANICAL WORKMANSHIP

1. Workmanship shall be of highest quality in accordance with the best modern standards and in conformance with applicable codes.

2. The dimensional tolerances specified on the drawings shall be interpreted as the maximum permissible deviations from the basic dimensions, or total indicated reading in the case of cylindrical components.
3. All dimensions given are to finished surfaces and the Contractor shall provide allowance for machining, shrinkage due to welding or fitting of components.
4. Whenever a fit or tolerance has not been specified on a dimension or by the tolerance table on the drawings, the Contractor shall use fits and tolerances normally acceptable for similar types of equipment, and generally consistent with the overall assembly. The tolerance table shall be used generally for components of secondary importance where their accuracy will have a minor effect on the overall performance of the equipment.
5. Since the purpose of the Roll Mechanisms is to serve as accurate measuring instrument within an aerodynamic facility, it is essential that surfaces exposed to the tunnel airflow be smooth and relatively free from discontinuities. To satisfy these requirements, accumulation of individual errors, even if they are within the dimensional tolerances defined on the drawings, will not be permitted if this results in errors, which exceed the tolerances specified on the drawings for subassemblies and assemblies.
6. All components shall be fabricated and finished in accordance with the best commercial practices. Particular attention shall be given to: freedom from blemishes, defects, burrs, and sharp edges; accuracy of cleaning; neatness of welding, and surface finishes; alignment of parts; tightness of threaded fasteners; thoroughness of mechanical fasteners and lockware assemblage.
7. Seals shall be fitted so that they are compressed along their full length for a minimum of 10% and a maximum of 50% of their free height. In no instance shall the seals be compressed to such extent as to cause or tend to cause damage or deterioration of seals. Furthermore the sealing continuity and integrity shall be such that the seals make essentially airtight joints.

#### E. SHOP ASSEMBLY

1. The Roll Mechanisms shall be assembled by the Contractor in the shop to verify proper fit-up of all components. Shop assembly guidelines will be developed by the Contractor and provided to AEDC for approval.



2. The responsibility for development of an assembly sequence leading to successful assembly of the hardware in accordance with the design rests solely with the Contractor.
3. The Roll Mechanisms shall be fully assembled in the shop.
4. The application of Loctite or safety wire to fasteners should be deferred where subsequent shop disassembly or adjustments will be made.

### 3.2 INSTALLATION

- A. The Roll Mechanism will be installed at the job site by AEDC.

### **END OF SPECIFICATIONS**